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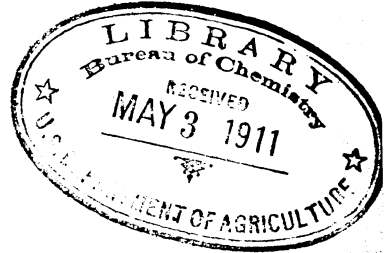
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BUREAU OF ANIMAL INDUSTRY.—CIRCULAR 179.

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COW-TESTING ASSOCIATIONS.



BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., March 14, 1911.

SIR: I have the honor to transmit herewith a paper on "Cow-Testing Associations," by Mr. Helmer Rabild, in charge of dairy farming investigations in the Dairy Division of this bureau.

The low average production of the dairy cows of the United States is a condition that does more than any other one thing to prevent development and to render dairying unprofitable. The cow-testing associations afford a plan for testing the cows and keeping a systematic record of every cow in a herd, so that the unprofitable ones may be identified and eliminated, and also provide other cooperative advantages. These associations originated in Europe, where they worked so well that the plan was introduced with some modifications in the United States. This department has assisted State officials and institutions in promoting and directing the work, and the results have been very successful in many ways.

Mr. Rabild's paper gives the history of the movement, describes the plan of operation, and shows the advantages of these associations. This paper forms a part of the Twenty-sixth Annual Report of this bureau, but in order that it may be given a wider circulation I respectfully recommend that it be published also as a circular of this bureau.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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COW-TESTING ASSOCIATIONS.

COW-TESTING ASSOCIATIONS IN EUROPE.

ORIGIN.

The cow-testing movement in connection with dairying originated in Denmark and was a direct result of necessity. That little country during the latter part of the nineteenth century passed through a financial crisis, the result of which was a reorganization of agricultural activity. Destructive and expensive wars had drained the resources of the country and increased the national debt, and the farmer, upon whom fell the burden of taxation, was forced to follow that system of agriculture which promised the highest possible returns. Beef production had become unprofitable by reason of increased land values and discrimination in foreign markets. The good standing of Danish butter and the prices paid for it on the English market gave promise that dairying, if properly developed, might furnish a good source of revenue, and this industry, which previously had been carried on in an indifferent way, began to assume greater importance. It received a great stimulus by the organization of a few cooperative creameries, the first of which was organized in the year 1882. The cows on the farms had not been selected for dairy purposes, the average production of butter per cow in 1884 being only 112 pounds a year, and the farmer soon learned that more productive cows were an absolute necessity if he would derive any profit from the business. Some importations of dairy cattle of foreign breeds were made. These importations, however, brought in many cases disappointment and loss and were soon discontinued, and the farmers began, by studying the individuality of their native cows, to breed a strain of cattle which were especially suited for dairy purposes.

The cow-testing movement began in 1892, when State Counselor B. Bøggild, at a meeting of the Kildebrønd Creamery patrons in July of that year, explained how records of the individual performances of the cows could be obtained, and the result was that 14 farmers agreed to weigh the milk from each cow and send samples of it to the creamery. The creamery manager, Mr. Hansen, determined its richness by the Fjord centrifugal cream tester and published the record of the milk and butter yield from each cow, as well as the feed consumed. Shortly thereafter, and as a result of this, those men who had kept records formed the Kildebrønd Bull Association, with the object of improving their herds.

State Counselor Frederik Hansen, a dairy expert employed by the Government and the owner of a dairy farm, had for several years studied the richness of the milk of individual cows by occasionally taking samples to the creamery for testing, and he had begun weeding out the animals in his herd which gave poor milk, thereby increasing the richness of the herd's milk. His neighbors who sent milk to the same creamery, noticing the increase in richness of the milk from his herd, began to inquire into the cause of it, and when sufficient interest had developed Mrs. Hansen, his wife, suggested that an association be formed in the neighborhood for the purpose of investigating the richness of the milk of individual cows and the economy of their production, so that each member of this association might obtain the same benefit that Mr. Hansen had derived from such investigations.

A meeting was called for this purpose January 23, 1895, on the farm of Søren Peter Knudsen, at Lille Skovgaard, Vejen, and the first cooperative cow-testing association was organized. A dairy expert was employed to make examination of the richness of the milk with the Gerber butyrometer and keep the milk and feed records. Active operations began May 1, 1895, with 13 members, and so satisfactory have been the results that the association now numbers 24 members, with 522 cows, and employs 2 men as cow testers.

GROWTH OF THE MOVEMENT.

Another association was organized later during the same year, and since then the movement has grown wonderfully. From Denmark it has spread to other European countries.

The following table shows the growth of the cow-testing movement in Europe. The figures given show the number of associations in the various countries, by years:

Number of cow-testing associations annually in operation in European countries, 1895 to 1909.

Year.	Denmark.	Germany.	Sweden.	Norway.	Finland.	Holland.	Russia.	Scotland.
1895	2							
1896	15							
1897	30	1						
1898	88	2	1	2				
1899	170	3	8	6	1			
1900	219	4	28	19	2			
1901	260	9	71	60	3			
1902	307	18	136	108	4			
1903	362	29	188	137	7		a 1	
1904	415	63	270	145	11	b 36	(a)	4
1905	448	63	333	139	17		(a)	1
1906	479	63	413	142	38		(a)	2
1907	479	63	486	145	64	86	(a)	5
1908	508	207	593	146	83	(c)	(a)	7
1909	530	207	662	146	99	(c)	d 52	13
								18

* Organization in Russia began in 1903; number of associations organized subsequently is not known.

° Number organized up to 1904.

• The development of these associations has continued, but figures are not available.

• Approximate number in existence.

PURPOSE AND PLAN OF THE ASSOCIATIONS.

The primary purpose of the cow-testing movement was to obtain records of the yearly production of milk and butter from each individual cow in the herds of the members, and with these data as a basis, by the selection of the best producing cows for breeding purposes, to develop a strain of cows which would produce a large quantity of milk rich in butterfat. Later it was found that to judge the quality of the individuals it was necessary in addition to keep account of the amount of feed consumed by each cow, in order to learn which of them utilized the feed to the best advantage. Many of these associations do not take into consideration the cost of the feed nor the price of products, but use the feed-unit system for this determination. By the feed-unit system the nutritive values of all feeds are reduced to a common basis, and that cow is considered best which combines the greatest yield of milk per 100 feed units with the largest production of butterfat.

It was not long before the work was extended to include also the cost of feeding and raising calves and young stock, of producing pork, and of keeping horses. It has even been extended to the keeping of records of yields of different fields with different crops, and much good has thus been accomplished, as the records furnish a good basis for comparing different systems of farm management, cultivation, crop rotation, etc.

The cow-testing associations of Denmark have on an average 22 members each and 390 cows. Each association employs an expert dairyman to make periodical visits to the farms of the members. At each visit he remains twenty-four hours, and obtains records, by actual weighing and testing, of the amount of feed consumed by each animal and the amount of milk and butterfat each cow yields during the twenty-four hours he is at the farm. With these data as a basis, he calculates the amount of feed each cow consumes for the entire year, as well as the amount of milk and butter she produces.

In case the association keeps records of other animal production, the cow tester obtains from the farmer information with reference to the amount of feed consumed by each animal, thus ascertaining the feed cost of keeping the animal; and by making occasional weighings of the animal the cost of producing 1 pound of gain is determined. Where records are kept of the growing of crops the cow tester ascertains from the farmer the total yield of a crop, as well as the total acreage, and calculates the yield per acre. If the grain has been sold, receipts must be shown for its delivery. By applying the total sum of expense in connection with the growing of the crop the cost of producing 1 bushel is calculated.

IMPROVEMENT AS SHOWN BY RECORDS.

Records of the first year's work of the cow-testing associations are not obtainable, but the method soon grew so much in importance and popularity that it was recognized by the Government and appropriations were made for promoting it. This assistance made it possible to collect the records of the various associations. Many of these records show very decided increases in average yield, and they furnish interesting material for study.

The following table shows the improvement in a herd owned by Mr. August Kinch at Beltagera, Sweden:

Record of a dairy herd in Sweden.

Testing period (365 days).	Average number of cows in herd.	Average milk yield per cow.	Average fat test of herd.	Average butter yield per cow.	Average feed units con- sumed per cow.	100 feed units gave—		Cost to pro- duce 100 pounds of milk.	Cost to produce 1 pound of butter.
						Milk.	Butter.		
		<i>Pounds.</i>	<i>Per cent.</i>	<i>Pounds.</i>		<i>Lbs.</i>	<i>Lbs.</i>	<i>Cents.</i>	<i>Cents.</i>
1899-1900.....	70	7,320	3.05	245	2,421	302	10.1	86.0	25.7
1900-1901.....	28	7,905	3.18	272	2,695	298	10.1	88.6	25.7
1901-2.....	46	9,008	3.20	317	2,566	350	12.3	74.1	21.1
1902-3.....	55	9,994	3.18	350	2,507	398	13.9	65.3	18.6
1903-4.....	61	10,584	3.22	376	2,587	407	14.5	63.5	17.9
1904-5.....	64	11,286	3.22	399	2,743	409	14.5	63.5	17.9
1905-6.....	71	11,333	3.21	401	3,035	372	13.2	69.6	19.7
1906-7.....	79	11,486	3.18	408	3,111	369	13.0	70.4	20.1
1907-8.....	77	11,023	3.17	385	3,075	358	12.5	72.5	20.8
1908-9.....	79	11,399	3.34	421	3,051	374	13.8	69.6	18.8
Increase(+) or decrease(-).....		+4,079	+0.29	+176	+630	+72	+3.7	-16.4	-6.9

* One Swedish feed-unit equals—1 kilogram (2.2 pounds) mixed grain; 1.2 kilogram (2.6 pounds) dried beet pulp; 1 kilogram (2.2 pounds) gluten feed; 2.5 kilograms (5.5 pounds) hay; 1.1 kilograms (2.4 pounds) wheat bran; 4 to 6 kilograms (9 to 13 pounds) straw; 0.9 kilogram (2 pounds) linseed cake; 6 to 10 kilograms (13 to 22 pounds) green clover; 0.8 kilogram (1.8 pounds) cotton-seed cake; 11 to 15 kilograms (24 to 33 pounds) turnips.

Mr. Kinch joined the cow-testing association in 1899. It will be noticed that he had 70 cows. The first year's testing revealed the fact that only 28 of them possessed sufficient merit to be deemed fit for breeding purposes, and the remainder of the herd was disposed of. The heifers of these 28 cows were raised and added to the herd, which kept increasing in numbers until in the seventh year it contained one more cow than in the first year. The increased yields shown in this table were accomplished by the selection of cows of large and economical production, and their progeny, combined with the use of improved sires. Naturally, with increasing production, the cows consumed more feed, something an owner can look at with satisfaction when he sees, as in this case, a gradual increase in yield per 100 feed units and a correspondingly satisfactory decrease in the cost of production. Assuming a cost of 2.6 cents for each feed unit and a price of 30 cents a pound for butter, the extra clear profit from 70 cows the last year was \$2,549.40 more than it was the first year, when

Mr. Kinch joined the cow-testing association. The cost of obtaining these records was less than \$1 per cow, or less than \$70 a year; and, assuming that the cost of purchasing good sires was offset by the increased commercial value of the herd, it means that an outlay of less than \$70 a year brought an income of \$2,549.40.

Assuming that the profit from the cows could be applied to pay off the mortgage on a farm, a man with a herd of 70 cows like those owned by Mr. Kinch in 1900 could pay off a mortgage of \$10,000 in 29 years; while the profits from 70 cows such as those owned by Mr. Kinch in 1909 would pay this mortgage in less than four years.

The following table shows the result of ten years' testing in the Lundatrakten Cow-Testing Association in Sweden:

Record of a Swedish cow-testing association for ten years.

Year.	Average milk yield per cow.	Average fat test.	Average butter yield per cow.	Average number of feed units per cow.	100 feed units gave—	
					Milk.	Butter.
	<i>Pounds.</i>	<i>Per cent.</i>	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>
First year	6,890	3.11	236	2,586	266	9.1
Second year	6,582	3.11	225	2,458	268	9.1
Third year	7,357	3.16	256	2,501	294	10.2
Fourth year	7,692	3.17	268	2,418	319	11.1
Fifth year	7,653	3.04	256	2,281	336	11.2
Sixth year	8,268	3.04	277	2,443	338	11.8
Seventh year	9,155	3.05	307	2,608	352	11.8
Eighth year	9,338	3.15	324	2,648	353	12.3
Ninth year	9,183	3.15	319	2,585	355	12.3
Tenth year	10,064	3.12	345	2,751	366	12.6
Increase	3,174	109	165	100	8.5

This association had in the tenth year 639 cows. Giving the butter a value of 30 cents a pound and the feed units a cost of 2.6 cents a unit, these 639 cows returned during the tenth year \$18,153.99 more than the same number would have returned during the first year, or nine times as much net profit. The cost of this splendid added income is less than \$1 per cow, or less than \$639 a year.

The cow-testing records in Denmark and Sweden show other instances where equally great improvements have been accomplished by profiting by the lessons the records teach. To duplicate the improvement shown in the foregoing table is indeed a worthy object for any cow-testing association.

THE COW TESTERS.

The cow testers (the men who collect the data and make the calculations) are young men who have been trained for this purpose. The agricultural schools have organized courses for the education of these men. One of the conditions for entrance to the schools is that the young men must have been raised on the farm and have had prac-

tical experience in the feeding and care of live stock. At the conclusion of this training, followed by one or two years' work in a cow-testing association, these men are greatly sought after for positions of trust and skill in connection with the dairy business. They can be found as managers and owners of dairies and operators of creameries, and so well recognized is the effect of this training that many creameries and dairies specify in their advertisements for men to fill these positions that the men must have had such training.

GENERAL RESULTS IN EUROPE.

Reports from Denmark show that the average production per cow in 1908 had increased to 224 pounds of butter. This average is exactly twice as much as it was in 1884. Much of this improvement has been accomplished as a result of the cow-testing movement. Reports from Sweden show an equal improvement. The more indirect results are seen in better system for all farm work, a livelier interest in the business of the farm, and a better understanding of the technical problems connected with its management. On the whole, the cow-testing associations have had a powerful influence in interesting the young people in farm life and keeping the population in the rural districts, and during the later years large farms are being cut up into smaller farms, in order that they may furnish homes for all the people desiring to engage in agricultural pursuits.

ASSOCIATIONS IN THE UNITED STATES.

OPPORTUNITY AND NEED.

According to the Twelfth Census the average production of butterfat per cow in the United States in 1900 was 145 pounds, which compared with the average production of 224 pounds of butter per cow in Denmark is entirely too low. The Bureau of Statistics of the Department of Agriculture reports that on January 1, 1910, there were 21,801,000 milch cows in the United States, and if it were possible to inaugurate a system whereby the average production per cow might be increased even 1 pound of butterfat in a year, this increase would amount to 21,801,000 pounds, which at the price of 30 cents a pound would be worth \$6,540,300. If such an increase could be brought about by better selection of cows and feeding stuffs, the sum mentioned could be figured practically as clear profit. Investigations by experiment stations and breeding associations show that there are a large number of cows which yield greatly in excess of this average, some reaching an amount as high as 800 or 900 pounds of butterfat in a year—one cow even 998 pounds. This being the case, there must be a large number of cows which yield less than 145 pounds of butterfat in a year.

Many reports of cow census investigations conducted by Hoard's Dairyman have been published during the last decade. These investigations have been made in representative sections of many dairy States, and show an average production but very little above that reported in the Twelfth Census. More than one-fourth of the herds reported failed to produce enough milk or butterfat to pay for their feed at market prices.

THE PRACTICAL DIFFICULTY.

The difficulty has been to devise a system whereby the unprofitable cows might be detected. It is a common belief among farmers that the man who does the milking knows the best cows in the herd, as well as the poorest; but numerous experiments have demonstrated clearly that this belief is not warranted. Many factors enter to lead the judgment astray. The cow which gives a generous flow of milk during the first few weeks of her period of lactation is usually regarded as the best cow. She may soon go down in her flow of milk, and perhaps goes dry for four or five months of the year, but this is not observed, and only the memory of the large flow she gave when fresh lingers in the mind of the owner.

Another cow may give only a fair flow of milk when she first comes in, and may not be regarded highly by her owner; but she may continue at the same rate of yield for a long period, and will in the end prove a great deal more valuable than the other cow. No milker can tell, without weighing the milk regularly, whether a cow gives 6,000 or 8,000 pounds of milk in a year; still the difference may prove the difference between profit and loss on that particular cow.

When the milk is valued according to its butterfat content unsupported estimates of the cow's performance are still more uncertain. It requires frequent testing to ascertain the average percentage of fat in the milk a cow yields; the test may vary greatly from milking to milking and from day to day. There may also be a great variation in the richness of the milk yielded by a cow when she is fresh as compared with a time later in the period of lactation.

And last, but not least, different cows show different feed requirements for the same production of milk or fat—a fact which is not generally thought of, and it is impossible for the feeder to estimate accurately the difference in cost of feeding the various cows for a year unless records of the feed are kept systematically.

An expression often heard among members of cow-testing associations during the first year is, "The cow I thought was my best cow is actually the poorest," which shows that impressions of the relative profitableness of the different cows in the herd, if formed without actual records, may be exactly contrary to the truth.

It is possible for the farmer, by weighing, to ascertain the amount of milk that each cow in the herd produces, and ever since the invention of the Babcock test he has had an easy means of knowing the fat content of the individual cow's milk. Very few farmers, however, have taken advantage of this opportunity; not because it would not pay them to do so, but largely because testing is tedious work, and requires care, regularity, and time to make it accurate. Many farmers have bought Babcock testers and have started in to do this work, but have given it up for the above reasons. It has the nature of an extra chore, and is apt to be neglected under the pressure of other work. To be successful, a system for obtaining these data must be independent of other work on the farm.

THE ELEMENTS OF ECONOMY.

In order to be able to decide intelligently which cows produce milk and butter economically and which do not, it is necessary to know three things about the individual cows in the herd. First, how much milk they give; and this must be known for a year, because a cow has to be fed for three hundred and sixty-five days. Second, how much butter fat there is in each cow's milk, for upon this depends the market value of the milk. And third, in order to form a correct idea as to the economical utilization of the feed, it is necessary to know the amount of feed consumed by the cow.

The cow's ability to convert feed into dairy products economically can not always be judged by net profit in dollars and cents, as this profit is dependent also upon the skill of the feeder and the sagacity with which he selects low-priced and at the same time suitable feeding stuffs. In other words, the same cow might yield very different results with different owners; therefore, in judging of net profits, the man as well as the cow should be considered. For this reason, cows in one herd should not be compared on this basis alone with cows in another herd, nor should the summaries of whole herds be thus compared. The product must be compared with the feed consumed in order to form an accurate opinion, and that cow is a good dairy cow which has the ability to convert a large amount of feed into a correspondingly large amount of valuable dairy products with the least waste. In the absence of any such system as the feed-unit system, whereby all feeds are brought to a common basis regardless of their cost, it is perhaps not practicable to express absolutely the exact degree of economy in the production of dairy products.

The dairyman usually fixes a certain quantity of butterfat as a minimum, and if a cow does not reach that production she is deemed undesirable and disposed of. The cow tester's duty is to study the

individuality of each cow in the herd and teach the farmer to feed her so that she will reach her maximum production consistent with an economical utilization of the feed.

THE FIRST AMERICAN ASSOCIATION.

The cow-testing movement in the United States was inaugurated by the writer, working under the direction of the State dairy and food department of Michigan, and the first association was organized at Fremont, Mich., September 26, 1905, under the name of the Newaygo County Dairy Testing Association. The general purpose for which it was formed was "to promote the dairy interests of its members, and particularly to provide means and methods for testing the milk of the cows of the members periodically." It consisted of 31 members, and 239 cows completed the first year's test. The officers of the association consisted of a president, a vice-president, a secretary and treasurer, and a board of nine directors. This board had the management of the business of the association and employed a cow tester, who made monthly visits to each herd, and as there are only twenty-six working days in a month, it was necessary for him in some cases to test two herds in one day.

METHODS OF OPERATION.

The cow tester arrives at the farm in the afternoon and remains there for twenty-four hours, when he is carried by the farmer to the farm of the next member in the association.

On his arrival at the stable the cow tester enters in a book which he carries for this purpose the name and number of each cow in the herd, whether she gives milk or not. As it is the purpose of the work to ascertain the actual status of the whole herd, as well as of the individual, every cow in the stable should be entered on this list. It is obvious that if only cows with large yields were entered on the list, at the end of the year the herd would show a higher average than the truth would warrant. For this reason, and in hope of obtaining commercial advantages from such high records, some dairymen have preferred not to have the whole herd tested; but it is a rule of the cow-testing association to obtain records of every animal in the herd which has had one calf, and no records are published where such is not the case.

The cow tester takes part in the feeding of the cows, and while doing so he weighs the amount of roughage and grain each cow receives and records these data in a book which he carries with him at all times. The milk yielded by each cow is weighed and samples of it are obtained for testing. Records of the feed and the yield for each

individual are again obtained and recorded the next morning, and after breakfast the fat determination is made. During the forenoon the calculations are made and entered in the record book, which at all times remains in the possession of the farmer.

The milking is done at the usual milking time, in order that the average yield may be obtained as accurately as possible. In case of competition between the herds, there may be a tendency to milk early in the morning on the day the tester is expected to arrive. In this way the yield for the testing day might be somewhat increased. To guard against this it is customary in some associations for the cow tester not to follow a regular route, so that it will be impossible for the dairyman to know the exact day on which to expect him.

In weighing the milk a "shotgun" can—a can 8 inches in diameter and 20 inches high—is used. It holds 35 pounds and has straight sides, with a handle near the bottom so that it may be easily emptied. The empty can should weigh even pounds so that mistakes in subtraction may be avoided. It has straight sides so that accurate samples may be obtained by the use of an instrument known as a "milk thief," as with an ordinary milk pail with a flaring top an accurate sample might not always be obtained, owing to the greater area of the milk at the surface than at the bottom. If the herd is large it is desirable to have two of these cans with straight sides so that the milker may pour the milk into them and proceed to milk the next cow without waiting for the tester to weigh and sample the milk. In this way time is saved in the stable.

For weighing the milk a special spring balance is used, weighing to 30 pounds and having two indicators, one of which is adjustable and should be set at zero when the weigh can is on the scales. The balance is graduated in tenths of pounds and is frequently tested so that any stretching of the spring may be immediately detected. The milk is poured from pail to pail two or three times and the sample for testing is taken immediately after such pouring is completed.

The fat determinations are invariably made at the farm. The reason for this is the difficulty in transporting the samples to the creamery without leakage, churning of the milk in hot weather, etc., any of which renders correct determination difficult. Another and equally important reason is that the dairyman becomes more interested in the work if it is done on the farm. He usually assists the expert with the testing and in this way acquires an understanding of the principles and the use of the Babcock test which he would not otherwise get.

If a cow is in heat or temporarily out of condition on the testing day, no sample of her milk is taken, as there is usually an abnormal fluctuation in the fat content at such times, and the calculations based

upon tests taken then may be several pounds too high or too low. The fact of such temporary abnormal condition is recorded in the herd book, and the average of the preceding and the following months' tests is used in the calculations.

Milk from fresh cows for the first three days can not be considered normal, and calculations based upon a test at that time may be very erroneous. It is the rule not to use the test of a cow's milk for calculations until she has attained a normal condition. If she has not reached this condition on testing day the following month's test is used as a basis for calculation. The yield for the first three days is omitted from the record, and the cow is considered as being dry when nearing the end of the lactation period.

The day upon which the test is made is called the testing day, and the records obtained on that day are used as a unit for each day in the period extending equal lengths of time on both sides of the testing day. This period is called the testing period, and is so marked off as to end exactly in the middle of the time between two testing days. Observance of this rule is very important, as it materially affects the accuracy of the work. The number of days in the testing period is understood to include both the dates mentioned as beginning and end of the period; thus, if the testing period begins March 15 and ends April 14, there will be thirty-one days in the testing period. The yields of milk and butterfat for the testing period are found by multiplying the yield on the testing day by the number of days in the period. The daily yield of milk is recorded in tenths and the monthly yield in whole pounds, while the yield of butterfat is recorded in tenths of a pound. If 12 tests are made in the year, 12 testing periods will result, and the sum of the records thus obtained will furnish a total summary of the various items for one year.

It is always advisable that the dairyman should make daily weighings of each cow's milk. By doing this he will discover at once any sudden fluctuation in the milk yield, and may in many cases be able to locate and remedy the cause. He should also note when each cow goes dry, when she is bred, the date of calving, and any changes in feed during the testing period, so that he may be able to give the cow tester this information when he arrives.

A MICHIGAN ASSOCIATION'S RECORD FOR THE FIRST FOUR YEARS.

The Newaygo County Dairy Testing Association, the first cow-testing association organized in the United States, has now been in operation for more than four years, and four whole years' records have been obtained. At the end of the first year a number of members withdrew from the association, but new members were readily found,

and the association is now able to get more members than it can take care of. The summaries for the first four years of the association's existence are given in the following table:

Yearly averages per cow of Newaygo County (Mich.) Dairy Testing Association.

Year.	Number of cows.	Milk.	Fat test.	Total butterfat.	Value of fat per pound.	Total value of fat.	Cost of roughage.	Cost of grain.	Total cost of feed.	Profit.	Returns for \$1 expended in feed.	Feed cost of 1 pound butterfat.	Feed cost of 100 pounds milk.
		Lbs.	P. ct.	Lbs.	Cts.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Cts.	Cts.
1906.....	239	5,386	4.04	215.0	23.3	50.27	20.92	8.36	29.28	20.99	1.72	13.6	55
1907.....	267	5,467	4.02	219.7	29.1	63.85	24.88	11.54	36.42	27.43	1.75	16.6	67
1908.....	254	6,007	4.21	252.8	27.3	69.99	25.60	14.07	39.66	29.33	1.74	15.7	68
1909.....	272	6,170	4.28	264.6	31.2	82.48	27.04	14.95	41.99	40.44	1.96	15.9	68

The following table gives the yearly averages of nine herds which were in the association from the beginning:

Yearly averages per cow of nine herds for four years.

Year.	Number of cows.	Milk.	Fat test.	Total butterfat.	Value of fat per pound.	Total value of fat.	Cost of roughage.	Cost of grain.	Total cost of feed.	Profit.	Returns for \$1 expended.	Feed cost of 1 pound butterfat.	Feed cost of 100 pounds milk.
		Lbs.	Per ct.	Lbs.	Cents.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Cents.	Cents.
1906.....	70	5,802	4.01	232.7	23.5	54.66	21.52	11.71	33.23	21.43	1.64	14.3	57.2
1907.....	85	5,987	4.08	241.4	29.4	71.02	25.59	13.70	39.29	31.73	1.81	16.3	65.6
1908.....	86	6,011	4.29	258.2	27.4	70.70	24.97	15.64	40.61	30.09	1.74	15.7	67.6
1909.....	89	6,426	4.32	277.6	31.2	86.52	27.26	16.44	43.70	42.82	1.98	15.7	68.0

These tables show a continuous increase in the average production. The richness of the milk has also increased. The average profit per cow has been doubled. Some of this increase in profit is partly accounted for by the increase in the price of butterfat, although feed prices show an almost corresponding increase. In these calculations it has been assumed that the value of the calf, skim milk, and manure from each cow would offset the cost of stabling, labor, and caring for her.

METHOD OF ORGANIZING.

The usual way of organizing an association has been to ascertain the extent of the interest in dairying in a community, and to call a meeting and explain the merits of the cow-testing association as an institution. If enough interest is exhibited to warrant going on with the work, a temporary organization is effected, and the neighborhood is thoroughly canvassed during the following few days in search of

additional members for the association. When enough have been secured a second meeting is called, at which the organization is perfected, officers elected, and by-laws adopted.

In order to support a cow-testing association it is necessary that there should be 26 herds, conveniently located, and a sufficient number of cows so that the tester can get a reasonably good salary. As it is each member's duty to furnish the tester's conveyance to his next place of work, it is necessary that the farms of the members be located near enough together so he can be conveyed without inconvenience. A distance of 2 miles is not too great to give satisfaction, and the conveyance is often furnished by some passer-by. If the cow tester keeps his own horse and buggy, as is the case in some associations, a larger territory is usually accommodated. In such cases the members must furnish feed and stabling for his horse. The charge to the farmer is usually \$1 a year for each cow. This money constitutes the pay of the tester; and it is desirable that there should be not less than 400 cows in an association, in which case the tester gets \$400 a year. In addition he gets his board and lodging free of charge at the farm where he is working. There being only twenty-six working days in a month, it is not possible to have more than 26 members, except in cases where two men with small herds live very close together so that it is possible to test both herds in one day. On such farms the regular milking time is fixed so that the tester can attend to the weighing and testing in the first herd and still have plenty of time to get to the second herd by the regular milking hour. In addition to the \$1 a cow, the farmer pays a membership fee of 25 cents yearly. This money, which for 26 members amounts to \$6.50, is used for paying incidental expenses, postage, cost of sulphuric acid, etc.

THE TESTING OUTFIT.

A testing outfit consists of a 12-bottle Babcock tester with glass-ware, two "shotgun" cans in which to weigh the milk, a spring balance, a "milk thief," and the necessary books and record blanks. The outfit, with the Babcock tester, is usually furnished by the State authorities, but in case it must be purchased by the association assessments have to be levied for this purpose unless the number of cows is great enough so that it can be paid for out of the fund collected at the rate of \$1 a cow. The necessary books and blanks have in some cases been provided by the United States Department of Agriculture until such time as the States have appropriations from which to supply these. The States of Michigan, Wisconsin, Vermont, Ohio, Iowa, and Maine now have provision for supplying this material to associations within their own borders.

QUALIFICATIONS OF THE TESTER.

The cow tester has much to do with the successful working of an association. He should be well fitted temperamentally and should have had special training for the work. Punctuality, regularity, and accuracy are of great importance, for unless he has these qualities the records may not be a true indication of the value of the respective cows. The tester should also have the ability to advise and teach the farmers, and for this reason it is necessary that he be constituted temperamentally to give advice in such a manner that it will be accepted and followed.

The work of a cow-testing association depends largely for its success upon the capability, reliability, and conscientiousness of the tester; but, on the other hand, the result of this work depends also upon the members. They should be willing to profit by the lessons which the cow testing teaches and ready to put into effect such changes in feed, stabling, and operation of the dairy as the records show will be profitable.

In this country, as well as in Europe, the position of cow tester offers excellent opportunities for dairy students to gain practical experience and is the best kind of school to fit them for responsible positions in connection with dairy work.

ACCURACY OF RESULTS OBTAINED BY VARIOUS TESTING METHODS.

Through the kindness of Prof. T. L. Haecker, access was had to the records kept of the production of the herd at the Minnesota State Experiment Station, St. Paul, Minn., where weights and Babcock tests of every milking of each cow in the herd have been recorded for nearly twenty years. The accuracy of the method used by the cow-testing associations was determined by comparing the yields as estimated by them and outlined in this publication with the actual yields as determined by weighing and testing each milking.

The accuracy was also determined of the estimated yearly yields as calculated by each of the following methods: (1) Taking the weights and a test of the composite sample of eight milkings in the middle of each month; (2) taking the same for four milkings in the middle of each month; (3) taking the product of one day in the middle of each three-week period; (4) taking the product of one day in the middle of each two-week period. In each of these methods the yields for each period were estimated and the sum of the periods was taken as the total for the year.

The following table shows the variations from the actual yields obtained by each of these five methods, the percentages of difference above or below the actual yields being shown in each case. The maximum variation by the cow-testing association method was not

over 5.1 per cent for any one year, and this method compares favorably for accuracy with any of the others. The table shows the maximum per cent of variation for any one year and the per cent of total difference from the actual yield for nine years for each of the methods.

Variations from actual yield of estimated yield of milk and butterfat as determined by various methods.

	Milk.					Butterfat.				
	Cow-testing association method.	Eight milkings; composite.	Four milkings; composite.	One day in three weeks.	One day in two weeks (five years).	Cow-testing association method.	Eight milkings; composite.	Four milkings; composite.	One day in three weeks.	One day in two weeks (five years).
Cow 1:	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Maximum variation	-3.3	-2.5	+3.1	-2.7	-1.6	+2.8	+3.2	+3.6	-4.6	-1.9
Total difference	-9	-6	-8	-5	-6	+3	-8	-7	-8	-1.2
Cow 2:										
Maximum variation	+2.1	-2.3	-2.3	-2.9	-1.7	+2.9	+3.5	+3.9	+5.6	-3.1
Total difference	-8	-9	-8	-1.0	-8	-8	+0	+6	+3	-1.8
Cow 3:										
Maximum variation	-4.9	-3.2	-3.8	-2.3	-2.7	+2.9	-3.8	-3.9	+5.7	-3.9
Total difference	-8	-9	-8	-3	-1.5	-1.1	-1.4	-6	-4	-2.7
Cow 4:										
Maximum variation	+2.6	-1.9	-2.6	-2.6	-3.3	-4.2	-4.3	-5.3	+4.4	-4.8
Total difference	-1	-4	-5	-5	-1.9	-2	-5	-7	+7	-2.7
Cow 5:										
Maximum variation	-3.7	-9	-2.8	-3.8	-5.2	-5.1	+2.9	+4.4	-3.2	-3.0
Total difference	-1.2	-3	-1.0	-1.3	-1.6	+0	-4	-1.1	-4	-1.2
Cow 6:										
Maximum variation	-3.9	-3.3	-3.8	-4.5	-1.8	-4.8	+3.5	-3.9	+4.3	-1.6
Total difference	-1.1	-9	-1.1	+0	-3	-6	-5	-5	+1.2	-4
Cow 7:										
Maximum variation	-4.3	-4.0	-4.5	-3.8	-2.0	-4.5	-3.3	-6.1	-5.1	-2.7
Total difference	-2.0	-1.2	-1.8	-6	-1.3	-1.7	-9	-1.3	-7	-1.5

In the method used by the cow-testing associations the total difference for a nine-year period is in no case over 2 per cent from the actual yield.

When we consider that the cow-testing association method means the weighing and testing of the milk just one day a month, and that the results are as close to the actual as above stated, we must conclude that the records of performance as found by the cow-testing association method are sufficiently accurate to enable the dairyman to weed out his unprofitable cows.

MEETINGS.

The associations hold monthly meetings for the discussion of topics of interest to dairymen. A programme committee selects from the members one or two to lead in the discussion, and occasionally outside speakers are invited. The meetings are usually held at the homes of the members and often take the form of a picnic. On such occasions there is free discussion and many valuable ideas are exchanged. After lunch a tour is made of the farm, and the crops as well as live stock and buildings are inspected.

GROWTH IN THE UNITED STATES.

The following table shows the growth of the movement in the United States:

Number of cow-testing associations in the United States, 1905 to 1910.

States.	Number of associations in operation.					
	1905.	1906.	1907.	1908.	1909.	1910 (5 mos.).
Michigan	1	2	4	3	5	6
Maine				3	5	6
Wisconsin				3	10	12
Vermont				3	5	9
California					2	3
Iowa					2	3
Pennsylvania					1	2
Ohio					1	3
Washington				1	1	1
Colorado						1
Connecticut						1
Nebraska						1
New Hampshire						1
Oregon						1
New York						1
Maryland						1
Total in United States	1	2	4	12	32	52

RESULTS.

Perhaps the most important result of the cow-testing associations is the increased interest which members take in their work. Farm work, consisting as it does in large part of manual labor, is apt to become monotonous unless there is an intelligent interest in the operations and unless the farmer has something special in view. The monthly visit of the cow tester stimulates this interest; and while the primary object for which the association was organized is the selection and rejection of individual animals, the results, direct and indirect, cover a very broad field. -

The tester, being an expert dairyman, not only studies the individual animals in the herd as to their capacity for utilizing feed economically, but he also assists the farmer in selecting those feeds which contain the greatest amount of food nutrients at the lowest price, thereby creating a larger net return per cow, per acre, per dollar's worth of feed, and, last but not least, per man. This larger net return per cow is brought about not only by the increased yield of the cows, but by improved economy in the conversion of feed into finished product.

One of the direct results is improved breeding. Many testing associations have proved to be forerunners of breeding associations, or bull associations, for the development of purebred cattle of breeds particularly adapted to the local conditions.

The cow-testing movement, being an organized effort for improvement, is conducive to better community spirit. At the monthly meetings problems of interest to dairymen are discussed, and this discussion often stimulates a friendly rivalry for attainment of the best results. The systematic and cooperative effort creates an interest in the growing of better forage crops and in better feeding; in more sanitary stabling and better care of the milk; it opens the eyes of the farmers to the value of system in their work, and leads to the application of better business methods.

Cooperative buying of feeding stuffs is a feature in nearly all cow-testing associations. At the monthly meetings the members place in the hands of the board of directors an order for the amount of feed stuffs they wish to buy. The aggregate of these orders often amounts to several carloads, and by buying in carload lots and for cash lower prices and freight rates are obtained. The officers of the associations study the markets for feed stuffs and are often able to take advantage of a low market. In this way business judgment is stimulated and the individual member is enabled to reap the benefit of the business judgment of his more experienced coworkers.

The work, broad as it is, has value not only for the farmer, but also for the creamery and the cheese factory, since it encourages better dairy methods at the same time that it procures larger remuneration for the dairymen. One of the causes of dissatisfaction with creameries and cheese factories has been the low average production of dairy commodities. The farmer has not had any systematic performance record of the production of his individual cows, and it is natural for him to think that some one else besides himself is responsible for the low return, and the creamery or cheese-factory manager, being the one who purchases his milk or cream, has received the blame. Many farmers have had only a half-hearted interest in dairying, because the average production of their herds has been so low that they could make but a small profit therefrom. The experience already gained in places where associations have been organized shows that with the elimination of the poor cows in the herd comes an interest in better cows and better care of the cows, and a tendency to make greater discrimination in price between good and poor animals. The introduction of better cows on the farms creates a desire for more of them, and a larger number of cows renders it possible for creameries and cheese factories to collect more milk or cream in a given territory, thus reducing the cost of collection.

The increased interest in dairying stimulates interest in dairy and kindred associations, and creates an interest in purebred stock. In the Newaygo County Dairy Testing Association, where during the first year only one man owned a purebred dairy bull, 22 such bulls were found among the herds during the second year; and while no

purebred cows at all were owned in the first year, 21 were bought during the second year. This interest has steadily increased, and during the third year a breeding association was organized. Such increased interest in purebred stock naturally affects the market for such stock, and entitles the movement to the hearty support of the breeders' associations of the different dairy breeds.

The consumer is interested not only in greater economy in the production of dairy commodities, but in improvement of their quality, which is promoted by sanitary stabling and better care of milk on the farm. These results follow from cow-testing associations wherever tried, and the consumer should for this reason give encouragement to such organizations.

RELATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE TO THE WORK.

The United States Department of Agriculture, through the Dairy Division of the Bureau of Animal Industry, has been largely instrumental in encouraging the inauguration of cow-testing associations in the various dairy States, and has always worked in cooperation with the State authorities. In many States no funds have been available for conducting the work, and the Department has furnished the services of an organizer and has supplied blanks and record books free of charge, in the hope that when the value of the work has been demonstrated the States would appropriate sufficient funds to carry it on.

Such appropriations should cover the expenses of organizing, such as salary and traveling expenses of an organizer; they should also provide for the printing of books and blanks for compilation of the records, and for publication of the same.

It is advisable that some State authority should supervise the work, and that occasional visits should be made to the associations, so that difficulties may be straightened out should they arise. It is also desirable that the supervisor of the work should attend the meetings held by the associations and give advice to the tester and check up his work, in order to get the highest degree of accuracy. Many of the States have already provided for such supervision, and for furnishing the material as well as for compiling the records, and it has been the policy of this Department to encourage the assumption of State control of the work.

In the promotion of this movement the Dairy Division has sought to forestall some of the defects under which the work in the older countries suffered during its earlier years. By furnishing the blank forms for the first few associations in each State, the aim has been to establish uniformity of methods, and by studying the work in the

various States and keeping in close touch with it, to be able at all times to suggest to those interested the latest improvements in the system.

CONTRACT USED IN THE ORGANIZATION OF A COW-TESTING ASSOCIATION.

Whereas the ——— Dairy Testing Association has been organized for the principal purpose of providing means for the cooperation of its members in testing the milk of their cows periodically and for otherwise improving their dairy interests; and whereas it is proposed by said association to engage a suitable person as soon as enough subscriptions are obtained to warrant said association in engaging such person, we, the undersigned members of said association, each for himself and not one for the other, agree to pay the sum of ——— for each cow set opposite our respective names to said association for that purpose. Said fees to be paid in quarterly installments in advance, the first payment to be made as soon as such person is engaged by said association. Each one of us also agrees to furnish board and lodging for said person for at least one day each month, and convey him to his next place of work. Said person shall not work Sundays, but shall have board and lodging over Sunday at the place where he is working Saturday.

CONSTITUTION AND BY-LAWS FOR A COW-TESTING ASSOCIATION.

ARTICLES OF ASSOCIATION.

We the undersigned, desiring to become incorporated under the provisions of act No. ——— (of the public acts of ———), entitled ———, and the acts amendatory thereof and supplementary thereto, do hereby make, execute, and adopt the following articles of association, to wit:

ARTICLE I. The name by which this association shall be known in law is ——— Dairy Testing Association.

ARTICLE II. The purpose for which it is formed is generally to promote the dairy interests of its members, and particularly to provide means and methods for improvement of the dairy qualities of cows and for the testing of the cows of its members periodically.

ARTICLE III. Its principal office and place of business shall be at ———.

ARTICLE IV. The number of its directors shall be ———.

ARTICLE V. The names of the directors for the first year of its existence are as follows: ———, ———.

ARTICLE VI. Any person may become a member of this association and be entitled to its benefits and privileges upon being accepted by the board of directors and upon complying with the requirements of the by-laws.

BY-LAWS.

ARTICLE I. *Meetings.*—An annual meeting of this association shall be held at a place to be designated by the board of directors, in ———, on the ——— day of ——— in each year, at 2 o'clock p. m., for the purpose of electing a board of directors, and for the transaction of such other business as may lawfully come before said meeting.

The president shall call one meeting each month for the purpose of discussing topics of interest to dairymen and shall at each meeting appoint a committee of three members who shall prepare a programme for the next meeting. No member shall be obliged to serve two months in succession on this committee.

Special meetings may be called by the board of directors or by the president, and notice thereof shall be given by the secretary, by mailing to each member a written or printed notice thereof at least five days prior to such meeting. Such notice shall state the object of the meeting, and no other business shall be transacted thereat.

ARTICLE II. *Board of directors.*—Section 1. The board of directors shall be elected at the annual meeting, the first election to be held on the — day of —, A. D. —.

Section 2. The board of directors shall have the management and control of the business of the association, and shall employ such agents as they may deem advisable, and fix the rates of compensation of all agents and employees.

Section 3. Whenever any vacancies occur in the board of directors by death, resignation, or otherwise, the same shall be filled without undue delay by the majority vote of the remaining members of the board. The person so chosen shall hold office until the next annual meeting or until his successor is elected and qualified.

Section 4. The board of directors shall meet on the first — of each month, at such hours and in such places as they may by resolution determine.

Section 5. A majority of the board of directors shall constitute a quorum at all meetings of the board.

ARTICLE III. *Officers.*—Section 1. The officers of the association shall consist of president, vice-president, secretary, and treasurer. The offices of secretary and treasurer may be held by the same person. The officers shall be elected by the board of directors from their own number by a majority vote of the whole number of directors. The first election shall be held immediately after the election of the board. Subsequent elections shall be held annually on the day of the regular meeting of the board next ensuing after the annual election, the day to be fixed by resolution of the board of directors.

Section 2. In case of death, resignation, or removal of any officer, the board shall elect his successor, who shall hold office for the unexpired term.

ARTICLE IV. *Membership.*—Any person acceptable to the board of directors may become a member upon paying a membership fee of 25 cents.

ARTICLE V. *Dues.*—Each member shall pay a fee of 25 cents annually on or before the — day of —; and in addition thereto shall pay quarterly dues to cover his share of the expense of cow testing, in proportion to the number of cows he has to be tested, the amount of such quarterly dues to be fixed by the board of directors, and paid as specified in a contract to be made for this purpose between the members.

No member shall be allowed to participate in the election of the board of directors who shall not have paid his annual dues in advance.

ARTICLE VI. *Amendments.*—These by-laws may be amended or added to by a majority vote of all the members present at the annual meeting or at a special meeting called for the purpose.

